Most cells are up to 100 micrometres; organelles are up to 10 micrometres.

Bacteria are up to 1 micrometre.

Viruses are up to 100 nanometres.

Membranes are 10 nanometres thick, and molecules are near 1 nanometre.

All of these objects are three-dimensional.

Light microscopes use light, which passes through the living or dead specimen, to form an image. Stains may be used to improve viewing of parts. Electron microscopes provide us with the greatest magnification (over 100 000×) and resolution. These use electrons passing through a specimen to form an image. It is hard to understand or visualize very small sizes, so it is important to appreciate relative size. Cells are relatively large, and then in decreasing size order are:

- organelles;
- bacteria;
- viruses;
- membranes;
- molecules.

Drawings or photographs are often enlarged. To calculate the magnification, you need this formula:

- magnification = size of image divided by size of specimen.

If you want to calculate the actual size of a specimen seen with a microscope, you need to know the diameter of the microscope's field of vision. This may be calculated with a special micrometer or with a simple ruler on a light microscope. The size of the specimen can then be calculated in the field.

Scale bars are often used with a micrograph or drawing so that actual size can be determined.

Limiting cell size

So, the cell is a small object. You may wonder why cells do not grow to larger sizes, especially since growth is one of the functions of life. There is a factor called the surface area to volume ratio that effectively limits the size of cells. In the cell, the rate of heat and waste production and rate of resource consumption are functions of (depend on) its volume. Most of the chemical reactions occur in the interior of the cell and its size affects the rate of these reactions. The surface of the cell, the membrane, controls what materials move in and out of the cell. Cells with more surface area per unit volume are able to move more materials in and out of the cell, for each unit volume of the cell.

As the width of an object such as a cell increases, the surface area also increases but at a much slower rate than the volume. This is shown by the following table in which you can see that the volume increases by a factor calculated by cubing the radius; at the same time, the surface area increases by a factor calculated by squaring the radius.

Sphere formulas:

- surface area = (four)(pi)(radius squared) = $4\pi r^2$
- volume = (four-thirds)(pi)(radius cubed) = $\frac{4}{3}\pi r^3$

Cell radius (r)	0.25 units	0.5 units	1.25 units
Surface area	0.79 units	3.14 units	7.07 units
Volume	0.06 units	0.52 units	1.77 units
Surface area : volume	13.17 : 1	6.04 : 1	3.99 : 1

This means that a large cell has relatively less surface area to bring in needed materials and to rid the cell of waste, than a small cell. Because of this, cells are limited as to the size they can attain and still be able to carry out the functions of life. Thus, large animals do not have larger cells, they have more cells.
Cells that are larger in size have modifications that allow them to function efficiently. This is accomplished by shape changes such as from spherical to long and thin. Also, some larger cells have infoldings or outfoldings to increase their surface relative to their volume.